Vertex Laser VL402 v.1.1 manual enu 2009

Vertex Laser II

Operator's Manual VL402 v.1.1

English

VERTEX LASER VL402 INSTRUMENT WITH BLUETOOTH®

FLEXIBLE AND ACCURATE HEIGHT- DISTANCE AND ANGLE MEASURING

Art no: 15-103-1010   VL402 Laser Class: 1 (USA, Canada) 3A (EU, other countries)

Product conforms to all provisions of US21CFR 1040.10 and 1040.11 and IEC 60825-1. For safety instructions and precautions, please see page 1937 in this manual.

Includes: Vertex Laser Measuring instrument, carrying case, battery and manual. Manuals are also available in PDF-format for download on www.haglofsweden.com If you cannot access the Internet, please call at +46 620 255 80 and a paper copy of the manual in your selected language will be sent to you.

Optional Accessories: T3 transponder/reflector

Plot Centre Staff (monopod) with adapter for T3 360˚

Tripod with assembling kit

Serial IR-receiver for data input in handheld computer or PC

Product Origin: Sweden

Declaration of conformity according to the EMC Directive 89/336/EEC with amendment 92/31/EEC, Low Voltage Directive 73/23/EEC and CE Marking Directive 93/68/EEC

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THE VERTEX LASER VL402

The Vertex Laser VL402 is a high quality measuring instrument, useful for anyone who needs reliable, fast and accurate distance-, height- or angle- measuring results. The instrument combines the proven accurate and safe measuring methods of laser, ultrasound and a tilt sensor into a small, flexible and unique product.

GENERAL INFORMATION: THE VERTEX LASER INSTRUMENT

The Vertex Laser instrument uses laser or ultrasound technology to calculate distance and a high quality tilt sensor to measure angles. The different measuring methods can be used individually or combined with each other. The choice of measuring method and technology is up to the operator. **In general terms, the ultrasound method offers more precise results for shorter distances, whereas the laser method will allow longer distance measuring and a quick presentation of measuring results without having to use a transponder**.

Data on heights, distances and angles can be transferred through a built-in Infrared transmitter to a PC or HHC, for storage and further processing. For transfer of results, a serial IR receiver is available as an optional accessory to the instrument. Model VL402 also has built-in Bluetooth for transfer of results.

The Vertex ultrasound method uses ultrasonic signals to obtain the exact distance from the measuring instrument to the T3 transponder. The height is calculated trigonometrically through the distance and the angle.
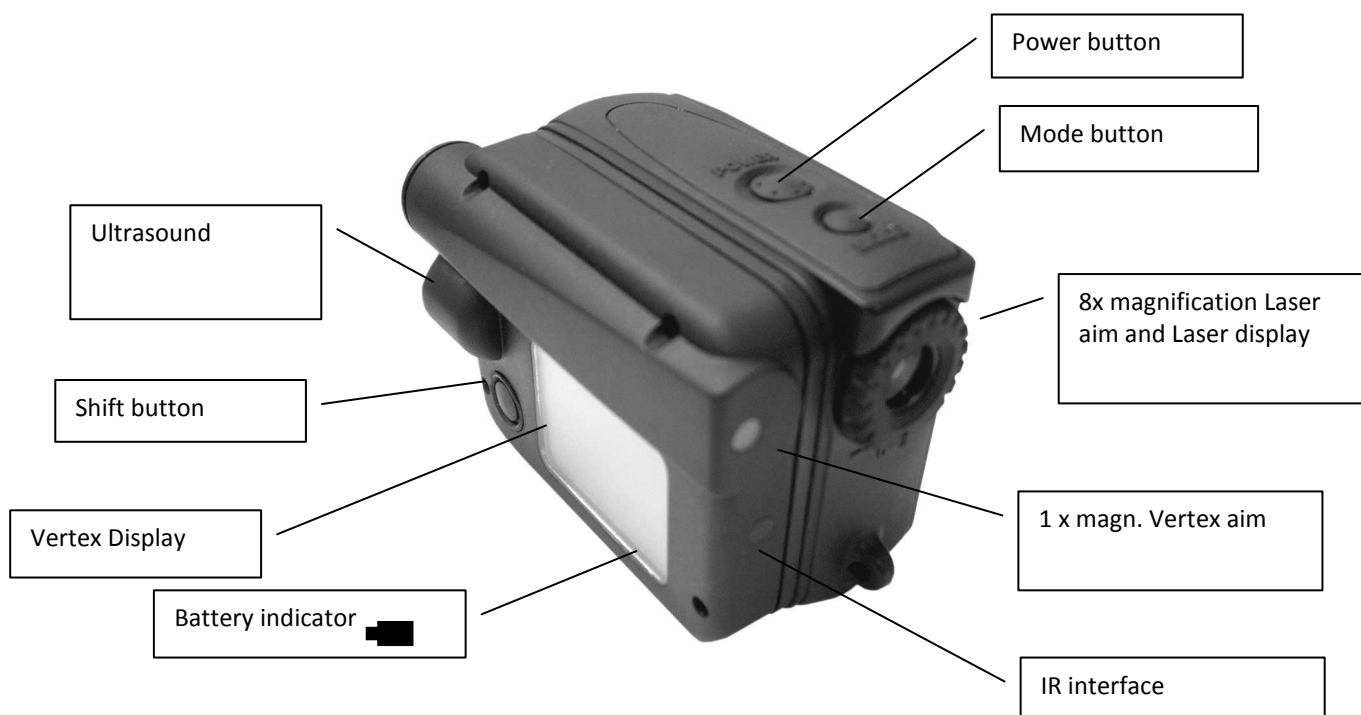
The T3 transponder is used when measuring with the Vertex ultrasound technology. The T3 transponder can also be used as a visible reference point when measuring with Laser technology. The T3 Transponder works both in a 60º mode for direct height measuring, for example pinned directly to a tree stem; or in a 360º mode when set onto the plot centre staff (art no CPIN), an ideal way to work when measuring in circular sample plots with the Vertex Ultrasound measuring technique.
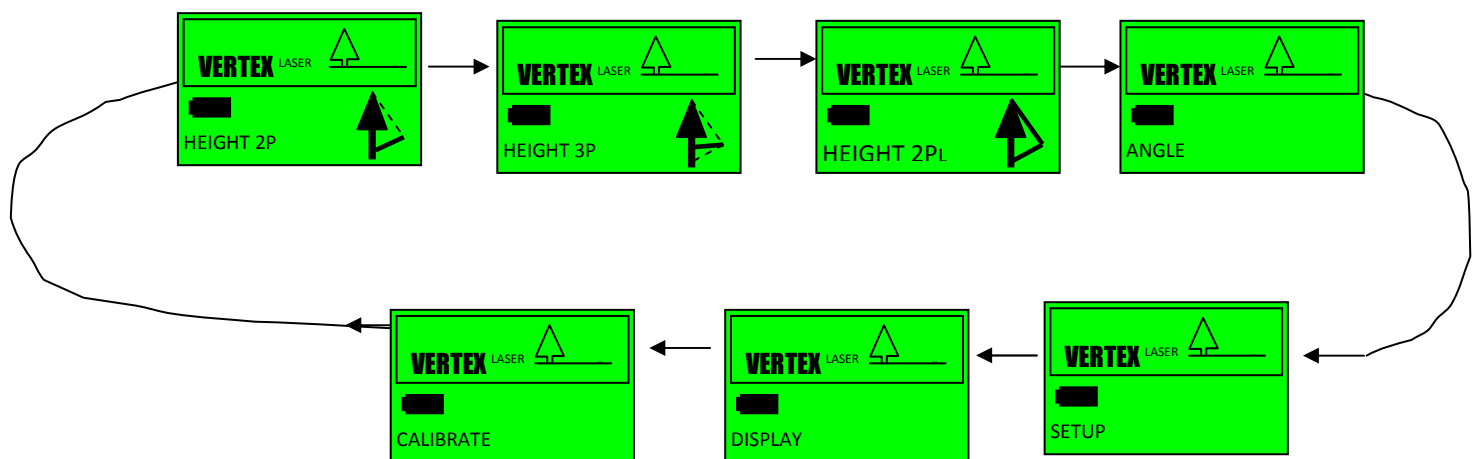

The ultrasound measuring technology works also when and if the target is not visible, as in completely or partially covered. The Vertex ultrasound is very useful when working in circular sample plots, and if the reference point (centre of plot) is covered by dense vegetation, trees or bushes. When measuring the angle to the reference point, the horizontal distance can be presented.

Working with relaskopes or prism sometimes offers difficulties if the underbrush is too thick. Poor sighting will prevent a correct diameter evaluation. With the Vertex Laser instrument's built in BAF function (Basal Area Function), the minimum tree diameter for trees to be included in the plot can be featured, when measuring the distance from the tree to the reference point/plot centre, using the Vertex ultrasound method.

The Laser part of the VL402 instrument emits invisible, eye safe infrared energy pulses that reflect off the selected target back to its optical receiver. *The laser is classified as Class 1 (USA and Canada) and as Class 3a (EC and other countries).* By measuring the time it takes for each pulse to travel from the rangefinder, to the target and back with sophisticated precision charge circuitry, the instrument instantly calculates distances. The maximum range of the Laser measuring method depends on the target's reflectivity, its colour, surface, finish, shape and size.

Power button

Mode button

Ultrasound

8x magnification Laser aim and Laser display

Shift button

Vertex Display

1 x magn. Vertex aim

Battery indicator

IR interface

MENU

VERTEX LASER
HEIGHT 2P

VERTEX LASER
HEIGHT 3P

VERTEX LASER
HEIGHT 2PL

VERTEX LASER
ANGLE

VERTEX LASER
CALIBRATE

VERTEX LASER
DISPLAY

VERTEX LASER
SETUP

SETUP

1. Press MODE to turn the instrument ON.

2. Select menu SETUP and press the MODE button.

3. Select distance and height unit by pressing the SHIFT button. Confirm by pressing MODE. Note! The selected unit is used in the Vertex Laser independent of which unit has been chosen in the Laser (see point 9).

4. Select Angle unit as DEG (degrees), GRAD (gradients) or % (percentage) by pressing SHIFT. Confirm by pressing MODE.

5. Set the P.OFFSET with SHIFT and MODE. A cursor appears under the digit. Use the SHIFT button to increase this digit. Confirm the digit by pressing MODE. Repeat for the next digit until the Pivot Offset is set.

6. Set the REF.HGT

7. Set M.DIST (manual distance)

8. Set the BAF factor for minimum diameter with Ultrasound. Following factors are supported:

--, 0.5, 1, 2, 3 (m^2/ha)

Alternatively

--, 5, 10, 15, 20 (ft^2/acre)

9. Select the distance unit in the Laser display. ***The unit shown in the Laser aim will not necessarily coincide with the unit shown in the display***. Any transferred information will be identical to the information shown in the display. Start the Laser by pressing POWER and select unit as m or Yard by depressing the Mode button. The selected unit is featured in the Laser display. Step out of this menu by pressing both SHIFT and MODE.
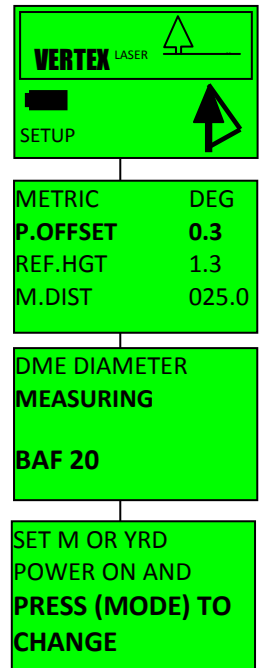
P.OFFSET

The Pivot Offset is the distance from the Vertex Laser instrument front to the virtual intersection point behind the instrument. The normal P.OFFSET is 0.3m/1.0ft.
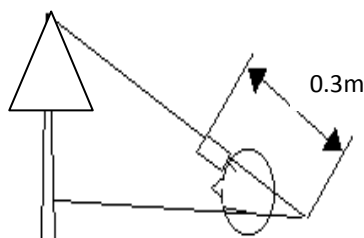
REF.HGT

The transponder height, the eye height or any other reference height equals the distance from the ground to a reference point. In most cases, the REF.HGT would equal the centre of the T3 transponder or other visible reference point. If the reference point is the ground, or the objects lowest point, REF.HGT should be set at zero (0). REF.HGT is always added to the height when measuring distance with ultrasound. REF.HGT is not used when measuring with laser except when using the one-shot method. Then the reference height (REF.HGT) should equal your eye height. Normal height to set the Transponder T3 is at 1.3m (breast height).
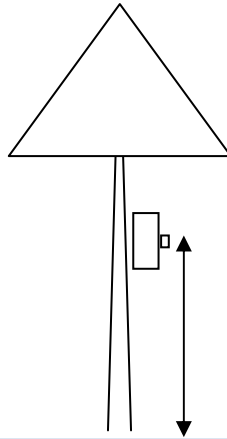

M.DIST

Setting a Manual Distance can be useful if a distance is already known (fixed distances between for example poles) or when neither Laser nor Ultrasound can be used for distance measuring for certain reasons – if, for example, larger objects cover the target object.

NOTE! The accuracy of a manually entered distance affects the height accuracy!

BAF

Working with relaskopes or prisms can sometimes offer difficulties when in the forest some trees cover others. The poor sighting can prevent a correct diameter measuring. With the Vertex built in BAF function, the minimum tree diameter for trees to be included can be featured. To use, measure the distance from the tree to the reference point with the Vertex Ultrasound method. The result will be the minimum diameter the tree must be to be included based on the set BAF-factors.
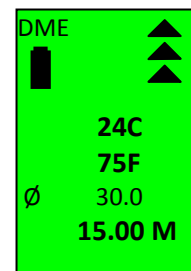
SELECT THE DISTANCE UNIT IN THE LASER

1. Press MODE to turn the instrument ON.
2. Select menu SETUP and keep pressing the MODE button until the last screen appears; SET M or YRD.
3. Start the Laser by pressing POWER and select unit as M (meter) or YRD (Yard) by keeping the MODE button depressed. The selected unit is featured in the Laser aim. Step out of this menu by pressing both SHIFT and MODE.
NOTE! This setting shown in the Laser aim does not affect the setting in the Vertex Laser instrument, where m or feet is used and shown in the display.

BUTTONS

SHIFT BUTTON

The SHIFT button is used when measuring distances with ultrasound, and to change menus or variables. SHIFT is also used to increase or decrease the intensity of the Vertex aim.

MODE BUTTON

The MODE button is used when measuring angles, and works as ENTER, to execute commands in the menu. The MODE button is also used to activate IR transfer of data.

Use the MODE button to select the Laser distance setup (English or Metric). To switch unit in the Laser (aim), select SETUP menu and SET M OR YRD (last menu in SETUP). When in this menu, keep the MODE button pressed down to switch between m or Yard. This measuring unit is only used in the Laser 8-time magnification aim and has no validity in the Vertex Laser display, where metric or feet is featured and used. Any transferred results will be the ones featured in the VL402 display.

POWER BUTTON

Press POWER to start the Laser. To start a measuring operation using Laser, press POWER again. Keep the POWER button depressed until a short beep goes off and the Laser performs a scanning measuring operation. This function is useful to obtain more correct result when measuring thin targets (power lines).
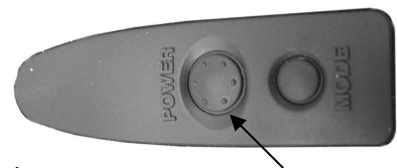
The Laser has an automatic turnoff time of 8 seconds of inactivity.

MODE+SHIFT BUTTONS

Press both MODE and SHIFT buttons to step out of a menu and to turn the Vertex Laser instrument OFF.

VERTEX AIM

The Vertex red dot cross hair aim has a 1 x magnification, with a highly visible red aim point sight. This sight is preferably used for close range targets.

The intensity of the Vertex aim is user adjustable. Press Shift when measuring a height or an angle to increase intensity of the cross hair.

LASER AIM

The Laser aim point is often used for distant targets. With an 8 x magnification, the laser aim is perfect for thin objects, for example power lines. The 8 x magnification makes it useful also if a target object is located close to other objects. Adjust the Laser aim sharpness by turning the adjustment ring around the Laser sight until desired sharpness.
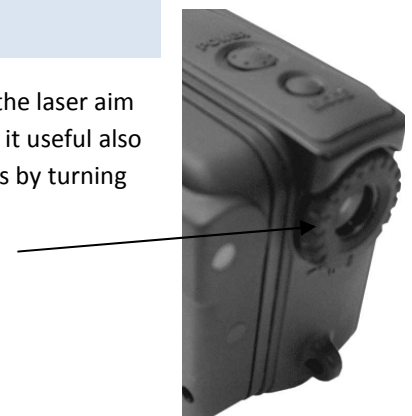
HEIGHT MEASURING WITH VL402

MEASURING HEIGHTS

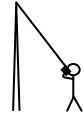The Vertex Laser instrument offers several different measuring methods for accurate height measuring:

**One shot**: Distance and angle to an optional part of the object measured with laser.

To be able to work with this method, you need to be on the same level as the bottom of the object to measure.

HEIGHT 3P: Distance and angle to optional part of the object measured with laser. The angle is measured at the lowest and the highest part of the object.
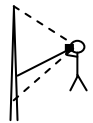
HEIGHT 2P: Distance and angle, to a reference point, measured with laser or ultrasound and a transponder/target. The top angle is measured.
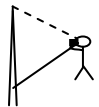
HEIGHT 2PL: Distance and angle to the bottom and to the top measured with laser. The method is ideal for leaning objects.
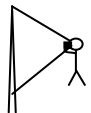
Useful and important knowledge: the Vertex Laser uses two additional variables when calculating a height. Those variables can be changed if necessary in the SETUP menu.
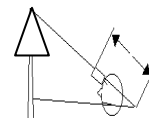
P.OFFSET: Distance from the Vertex Laser front to the intersection point.

REF.HGT: The transponder height, the eye height or any other reference height equals the distance from the ground to a reference point. In most cases, the REF.HGT would equal the centre of the T3 transponder or other visible reference point. If the reference point is the ground, or the objects lowest point, REF.HGT should be set at zero (0). REF.HGT is always added to the height when measuring distance with ultrasound. REF HGT is not used when measuring with laser except when using the one-shot method. In these cases, the reference height (REF.HGT) should equal your eye height. Normal height to set the Transponder is at 1.3m (breast height).

DISTANCE AND HEIGHT MEASURING WITH LASER

SD	15.8
HD	14.8
H	**2.3**
DEG	**8.6**

1. Press POWER to turn the Laser ON.

2. Aim and press POWER to measure with Laser.

The Vertex Laser instrument indicates with a short signal when a measuring result has been completed. The display features distance, horizontal distance, angle and height above horizontal plane (REF.HGT included).

Press both MODE and SHIFT buttons to step out of a menu and to turn the Vertex Laser OFF.

Use REF.HGT to add the distance from ground to eye to get the target's total height from the ground to the measuring point.

P. OFFSET should be set to 0.1 m/0.3 ft
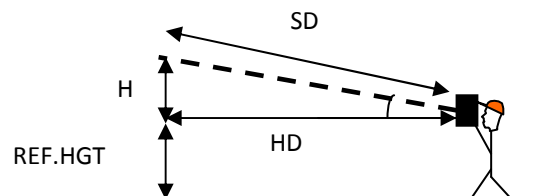
Objects that are far away or thin (power lines) can be difficult to visualize and to obtain measuring results from. With the Laser scanning function, activated when pressing the Power button, the best measuring result can be achieved. Press and keep POWER depressed until a beep signal indicates that a result has been measured and is featured in the VL402 display. When pressing the Power button, the VL402 searches for the correct angle to the measuring object. Once this is obtained, this signal is given and the height is calculated and displayed. ***This implies that you need to await the signal to go off to get the horizontal distance – and to get accurate results.***

DISTANCE MEASURING WITH ULTRASOUND

Make sure that the Vertex Laser is OFF. Start the T3 transponder by holding the ultrasonic element close to the transponder center and press SHIFT. Wait for two short beeps from the transponder. The T3 transponder is now ON and stays ON (=activated) for approximately 20 minutes.

To turn the T3 transponder OFF, repeat the "ON" procedure. Four beeps indicates that the Transponder is "OFF".

Ultrasonic pulses are attenuated differently with varying temperature, humidity, and atmospheric pressure. In open terrain without obstacles between the instrument and with the 60˚transponder, a range of 30m/100 ft or more can be obtained. (For details on the T3 transponder, please see page 6 in this manual.)

Calibration of the Vertex ultrasound unit should be made in current correct temperature to get highest possible precision. The speed of sound in air depends on several factors, but primarily on temperature. A built-in sensor is automatically compensating for changes in temperature. The instrument has a default calibration that will typically result in a distance error less than 1%. To obtain best accuracy it is recommended, however, to check and if necessary recalibrate the instrument at regular intervals -e.g. once a day.

For details on the calibration procedure, please see page 16 in this manual.

HEIGHT 3P WITH LASER
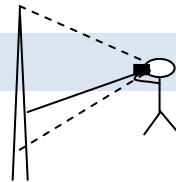
1. Press POWER to start the Laser (alternatively, turn the Vertex Laser ON by pressing MODE and choose menu HEIGHT 3P and confirm your choice with MODE). *The VL402 has a built-in energy saving function. If your measuring operation does not start from this point within just a few seconds, the Laser has to be reactivated with a short press on POWER.*

2. Aim at the centre (or other measuring point of your choice) and give a short press on POWER to get the distance and angle. Aim until a short beep goes off. The slope distance (SD), the horizontal distance (HD), the height (H) and the angle (DEG) are featured in the display.

3. Aim at the bottom of the target object or other reference point of your choice. Keep pressing MODE down until a beep goes off. Now release the MODE button.

4. Aim at the top of the object or other measuring point of your choice and keep MODE pressed down until another beep goes off. Now release the MODE button.

The height between the three (3) measured points and other data are now featured in the display. More heights on the same target object can be measured by repeating point 4 above.

Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.

HEIGHT 2P LASER WITH TRANSPONDER/TARGET
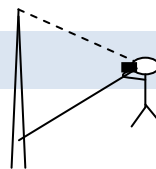
1. Press MODE to turn the instrument ON.

2. Select menu HEIGHT 2P and confirm choice by pressing the MODE button.

3. Turn the Laser ON by pressing POWER.

4. Aim at the T3 transponder (or other reference point) and press POWER to get the distance and angle to the object. Aim until a short beep goes off. Slope distance (SD), horizontal distance (HD) height (H) (REF.HGT included) and angle (DEG) are featured in the Vertex Laser display.

5. Aim at the top of the target object and keep MODE pressed down until a beep goes off. Now release the MODE button. SD, HD, DEG, and H are displayed.

More heights on the same target object can be measured by repeating point 5 above. To measure heights of a new target object, repeat from point 4 above, and use the HEIGHT 3P method (see description above).

VERTEX LASER	
HEIGHT 2P	

M.DIST	25.0
DME(MODE)	
LASER(POWER)	

SD	15.0
HD	14.9
H	**-1.9**
DEG	-7.3

SD	15.0
HD	**14.9**
DEG	-7.3
H	20.3

HEIGHT 2P WITH ULTRASOUND

1. Make sure that the T3 transponder is ON and

position it at the reference point, defined by REF.HGT.

2. Press MODE to turn the Vertex Laser instrument ON.

3. Select menu HEIGHT 2P and confirm choice by pressing the MODE button.

4. Aim at the T3 transponder with the Vertex sight and press MODE until a short beep goes off. Release the MODE button. Distance and angle are now featured in the display.

5. Aim at the top of the target object and keep MODE pressed down until a beep goes off. Now release the MODE button.

SD (Slope Distance), HD (Horizontal Distance), DEG (Angle), and H (Height) (REF HGT included) are now featured in the display. More heights on the same target object can be measured by repeating point 5 above.

Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.
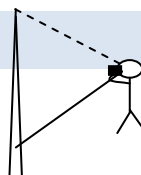
VERTEX LASER	
HEIGHT 2P	

M.DIST	25.0
DME(MODE)	
LASER(POWER)	

DME	
24C	
75F	
25.00 M	

SD	25.0
HD	24.6
DEG	-10.6
H	20.1

HEIGHT 2P MANUAL DISTANCE

1. Press MODE to turn the instrument ON.

2. Select menu HEIGHT 2P and press the MODE button to confirm your choice.

3. Accept the manual distance now shown in the display by a quick press on the MODE button. *If the manual distance shown in the display needs to be changed, this should first be done in the Setup menu (see pg 8 this manual).*

4. Aim at the reference point set at a known height (*Setup menu, pg8*) or at ground level (0) and press MODE to get the correct angle to the object. Aim & press MODE until a short beep goes off. Now release the MODE button.

5. Aim at the top of the object (or other point of your choice) and keep MODE pressed down until a beep goes off. Now release the MODE button.

Height (REF.HGT included) and other data are featured in the display. More heights on the same object can be measured by repeating point 5 above.

Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.

NOTE! The accuracy of the entered manual distance and reference height affects the height accuracy!

HEIGHT 2PL LASER 2-POINT MEASURING

1. Press MODE to turn the instrument ON.

2. Select menu HEIGHT 2PL and confirm your choice

by pressing MODE again.

3. Turn the Laser ON by pressing POWER.

4. Aim at the bottom of the target (or other reference point) and give a short press on POWER to get the distance and the angle to the object. Aim until a short beep goes off and the red cross reappears in your aiming sight again.

5. Aim at the top of the target or other measuring point and give a short press on POWER to get the distance and angle. Keep aiming until a short beep goes off.

Height (REF.HGT not included) and other data are now featured in the display.

Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.

ANGLE MEASURING

1. Press MODE to turn the instrument ON.
2. Select menu ANGLE and press MODE to confirm your choice.
3. Aim and keep MODE until a beep goes off. Release the MODE button.
The angle is now featured in the display (DEG).
Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.

HORIZONTAL DISTANCE WITH ULTRASOUND

1. Press MODE to turn the instrument ON.
2. Select menu ANGLE and press the MODE button to confirm your choice.
3. Aim at the T3 transponder with the Vertex 1x magnification sight and keep MODE pressed down until a beep goes off. Release the MODE button.
4. Give a short press on the SHIFT button to measure the horizontal distance (HDIST) to the transponder. Read the measured result in the display.
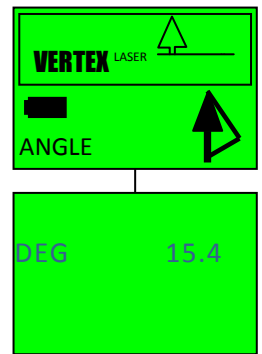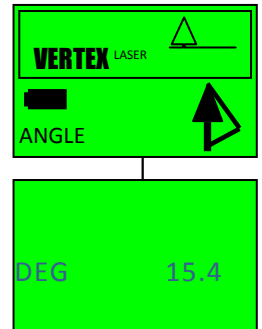Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.
Please also turn to page 12 and in this manual for details on Ultrasound measuring.

CALIBRATION OF ULTRASOUND

1. Make sure that the instrument has adjusted to current working temperature.
2. Turn the T3 transponder ON and place the centre of the transponder 10m/32.8ft away from the Vertex Laser front.
3. Turn on the VL402 with MODE. Aim the Vertex Laser at the transponder and select menu CALIBRATE. Confirm your choice with MODE.
When the number 10.00 appears in the display, the instrument is ready and calibrated.
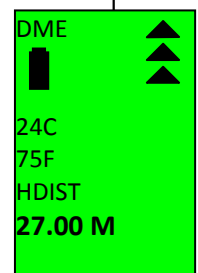
It is important that the temperature sensor is given enough time to correctly determine the ambient temperature. If you are carrying the instrument in your pocket you might have to allow up to 10 minutes before you can obtain best accuracy
An example: Your inner pocket holds +15C/60F. Outdoor air temperature is -5C/23F. The measurement result will show 10,40m/34.12Ft and not the correct 10,00m/32.81Ft.

The measurement inaccuracy pending on temperature is approximately 2 cm/C°.
The error will decrease rapidly, but the final accuracy might take up to 10 minutes to achieve. Taking this into account, calibrating the instrument before the sensor has had time to stabilize will make the error "permanent". The display will then show the correct 30.0ft for a short while, but a few minutes later the measurements will be inaccurate.

Never calibrate your instrument before it has stabilized at ambient temperature!!

Press both MODE and SHIFT to step out of a menu and to turn the Vertex Laser OFF.

DELTA HEIGHT

The Delta Height Function is used to calculate the height difference of a point at an imagined straight line between two fixed positions, and a third point, for example at a power line, where the line sag is closest to the ground. (More details at next page)

1. Go to the position where the line sag is closest to ground. Measure H1 using the 1-point laser method.

2. Measure H2 using the 1-point laser method

3. Accept H1 and H2 and H by pressing Mode. H is the calculated height to the point above the power line.

4. Measure the height h to the power line using the 1-point laser method.

The Delta Height (H-h) is calculated and featured in the display.

DELTA HEIGHT FUNCTION

The Delta Height Function is used to calculate the height difference of a point at an imagined straight line between two fixed positions, and a third point, for example at a power line, where the line sag is closest to the ground.
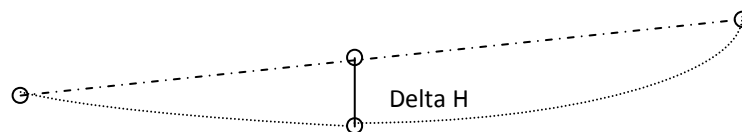
Delta H

INSTRUCTIONS

The Delta Height Function calculates the difference between two heights. The function REF. HEIGHT in the L402 Laser is therefore not so important in this case.

Always stand in a perpendicular position at the point where the Delta Height is measured.

OK
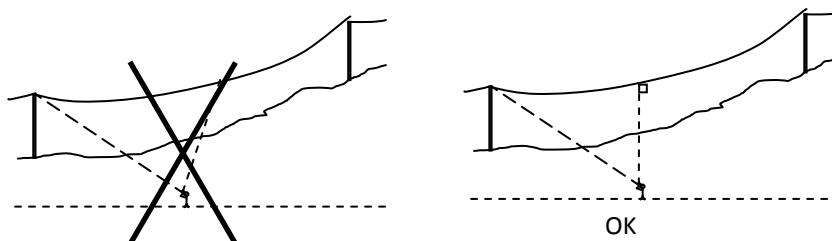
The Delta Height Function uses the horizontal distances and the heights from the two fixed positions to calculate the height to the point at the (imagined) straight line. If this point is not located in the middle of these two fixed positions, the importance of standing closely increases.
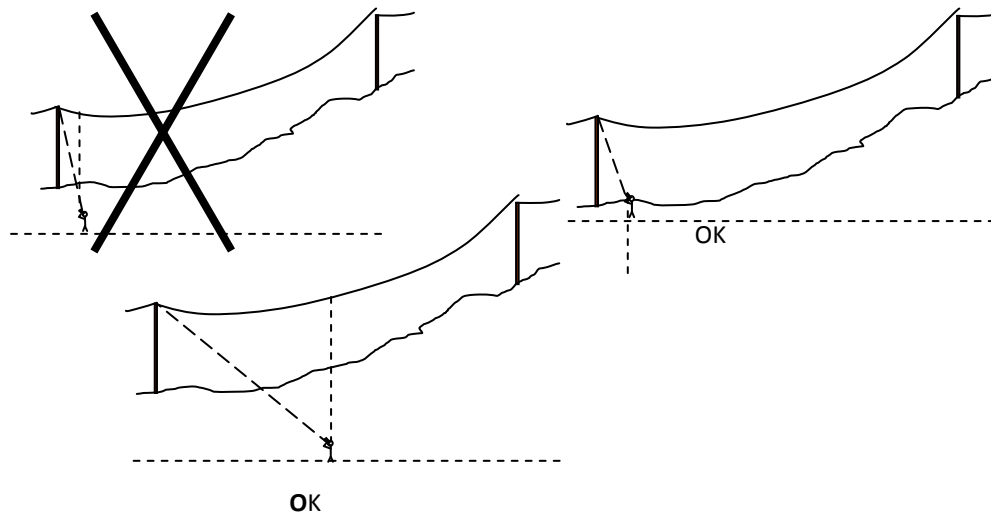
EXAMPLE

1. Go to the position where the line sag is closest to ground. Measure H1 using the 1-point laser method.

2. Measure H2 using the 1-point laser method
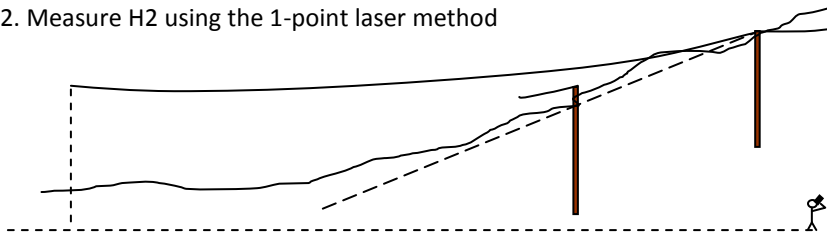
3. Accept H1 and H2 and H by pressing Mode. H is the calculated height to the point above the power line.
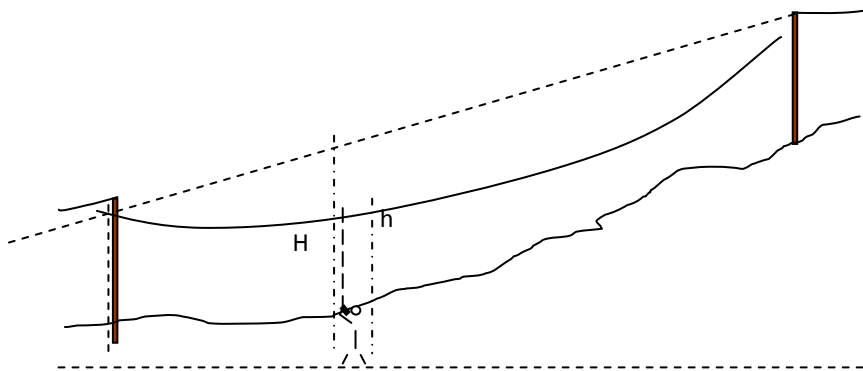
4. Measure the height h to the power line using the 1-point laser method.

The Delta Height (H-h) is calculated and featured in the display.

HAZARD TREE LIMIT: FUNCTION IN THE VL402 TO CALCULATE SECURITY DISTANCE

The VL402 V1.1 includes a useful function to calculate minimum distance from a tree top to, for example, a power line, given the scenario that the tree could fall or be cut down. The function is called TREE LIMIT in the VL402.
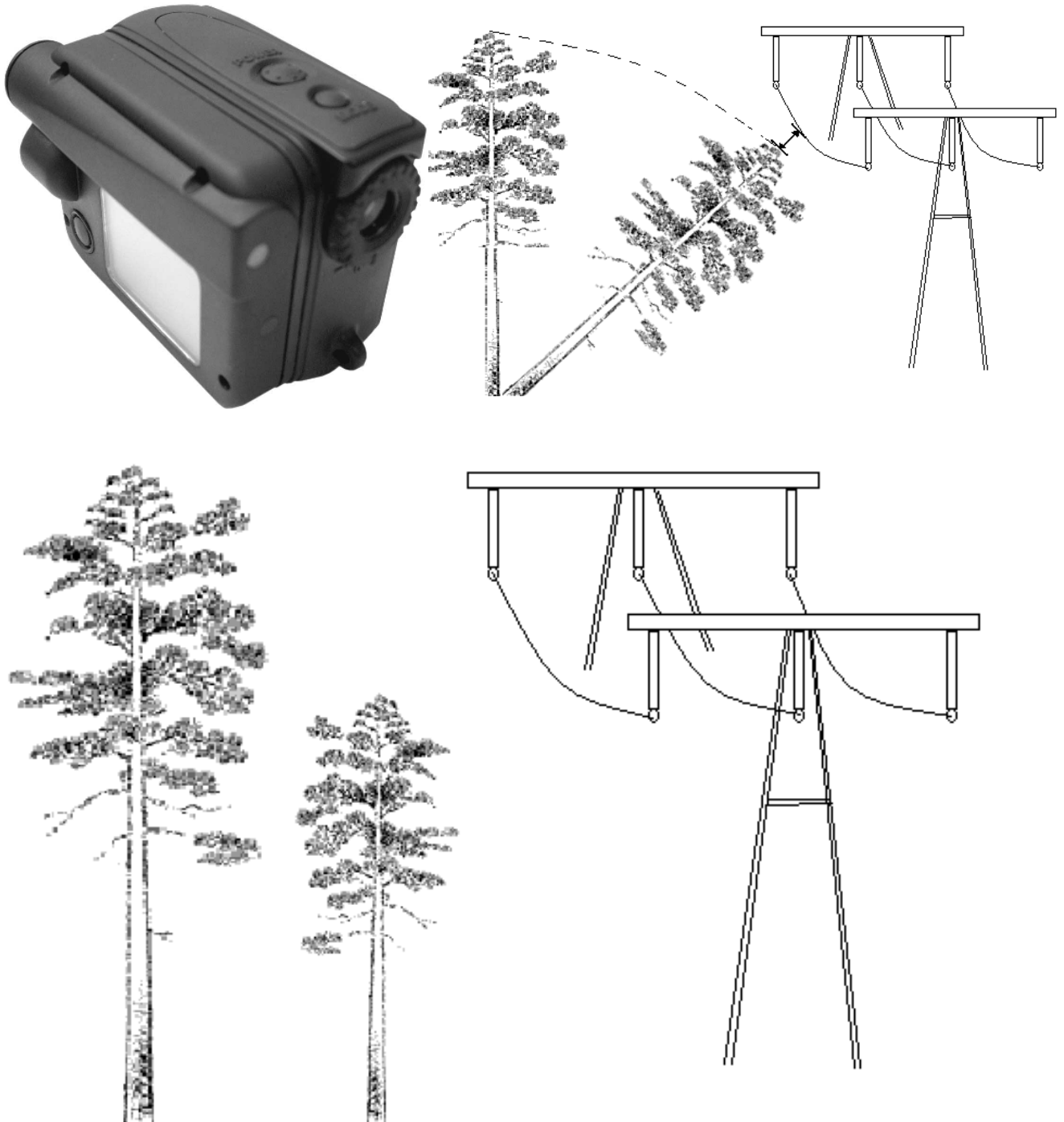
Note that it is recommended to work with a security margin, given that the measurements include uncertain factors that will affect the results. Certain calculations will presume that the object, for example a tree, is standing straight when measuring a height. Trees that are leaning in the opposite direction from the operator's position will be given a lower height measurement value, with certain functions in the VL402. Other factors of

uncertainty can affect the power line, such as cold/warm temperature, power output in the line, etc. If you are unsure where the laser beam actually hit when measuring, it is recommended to verify results with at least one more measuring operation.

The VL402 incorporates several functions for height measuring. Since smaller trees often prevent a free sight to the tree to measure, and also often prevent supplementary tree base measuring, the HEIGHT 1P function (one measuring, aiming at the tree top) is often used. The VL402 will, in such cases, presume that the tree base is leveled with the ground. Note that, in cases where the tree base/root is lower than ground level, a larger safety and security margin is necessary, since the tree height otherwise will be underestimated.

Below pictures show a tree and a power line. With a number of measurements with the VL402, the instrument can calculate the distance featured in picture 2. If this distance is small or negative, the tree top can reach the power line if felled. The function can also be used to calculate security distance as in picture 3.
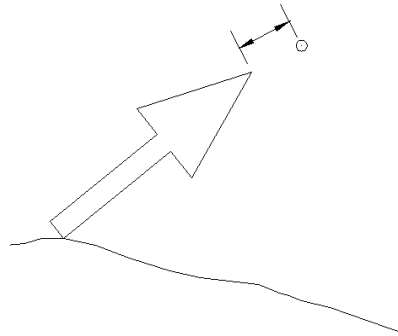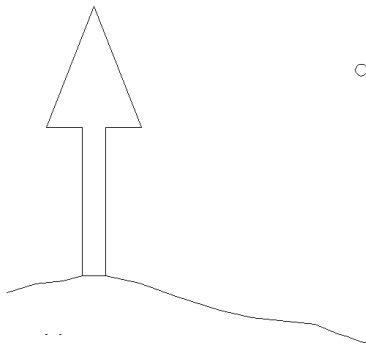
Picture 2
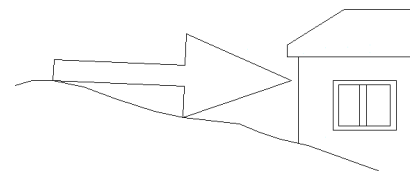
Picture 3

GENERAL MEASURING MODEL

The minimum distance to the power line is measured in two steps:

1. Measure or state the height to the power line (or other object).

2. Stand under the power line. Measure the tree height. The tree height and its position relative to the power line are registered and the minimum distance from the top to the power line is calculated.

HEIGHT 2P	HEIGHT 3P	HEIGHT 2PL	DELTA HGT	ANGLE	SETUP	CONTRAST	CALIBRATE	BLUETOOTH

CODE ▸ 12345

CODE   12345

BLUETOOTH ▸ ON
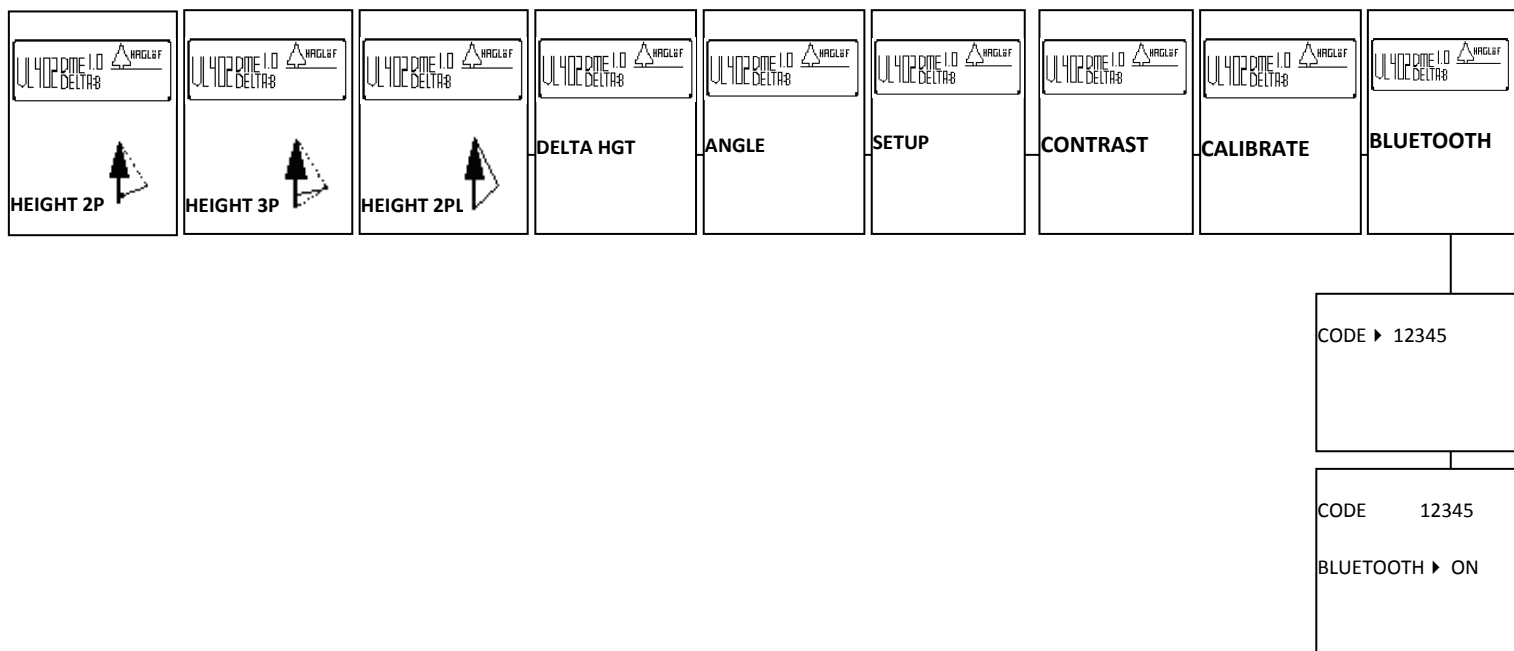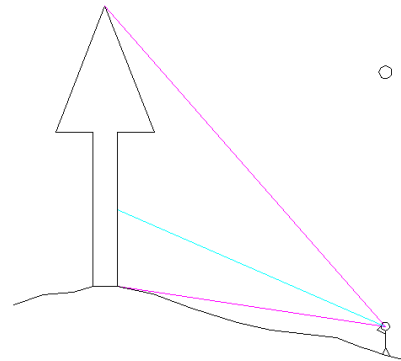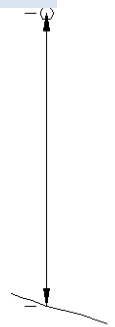
TREE LIMIT

Go to the SETUP menu and make sure that the P.OFFSET is correctly set (app. 0.3m) and that the EYE HGT is set as the distance from ground level to your eyes, usually app. 1.7m. If the ultra sound transponder needs to be used (in dense vegetation) check also that the TRP.HGT is correct in the VL402, normal setting 1.3m (breast height).

Start the VL402 by pressing MODE and go to menu TREE LIMIT. Press MODE. You can now choose if to state the power line height manually or if to measure it.
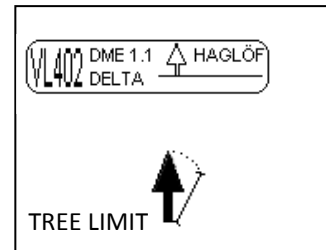
MANUAL REGISTER OF HEIGHT TO POWER LINE

If the height to the power line is known, choose method MANUAL in the menu OBJECT HGT and press MODE.

State the known height in meters by stepping up/down using the DME button. Proceed to the next digit with MODE. State the height as 00.0 if you wish to know where the top will touch ground in relation to your position when cutting the tree.
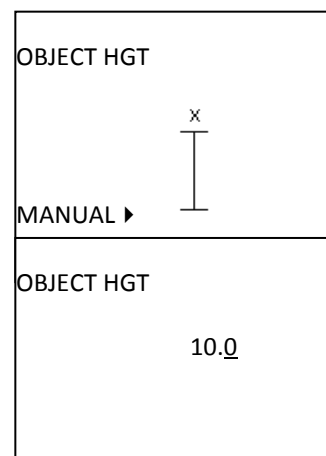
Press MODE when the last digit has been input to continue measuring tree height, see this manual.

MEASURING HEIGHT TO A POWER LINE

When the height to the power line is not known, it needs to be measured. This is done in the function MEAS in the OBJECT HGT menu. Choose the function MEAS with the DME button and press MODE. There are three methods to calculate correct height to the power line.

LASER   Laser measuring up to power line.

HEIGHT 1P   Height calculation with laser measuring and one angle.

HEIGHT 2P   Height calculation with laser and two angles.
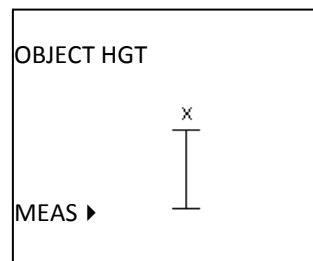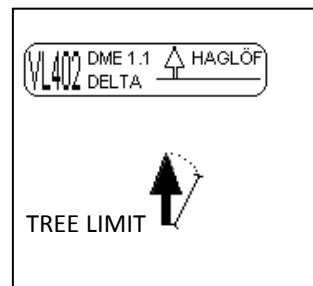
LASER

Method to use only if you are positioned with the VL402 at least 10m/32ft from the power line.

1. Stand just under the power line. Make sure that no objects are above the power line that you intend to measure with the laser, to avoid hitting something else with the laser beam.
2. Choose LASER method with the DME button. Press MODE.
3. Stand under the power line, start the laser in VL402 with one press at the POWER button.
4. Aim at the line and press POWER to measure the distance up to the power line.
5. The EYE REF distance will automatically be added to the measuring result. Repeat point 4 if needed.
6. Accept the height result by pressing MODE and to move on to measure tree heights, see this manual.
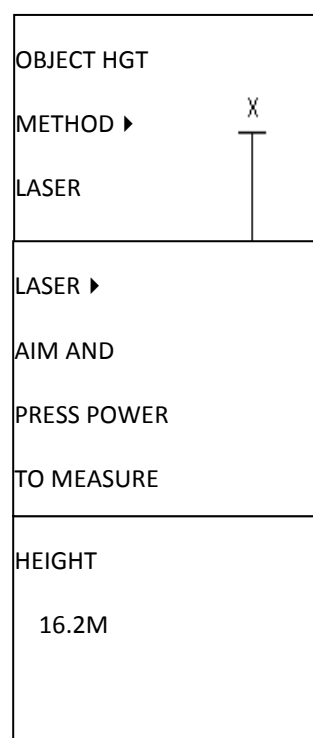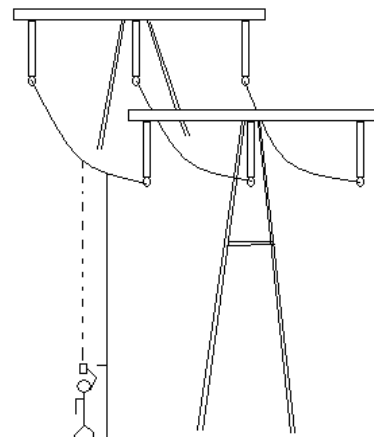
HEIGHT 1P

The Height 1P method is used to measure the height to the power line when you are positioned on a distance from the line. The minimum distance between the VL402 to the power line is 10m/32ft.

1. Stand at ground level under the power line. Make sure that no objects are above the line you intend to measure, to avoid hitting something else with the laser beam. If you accidentally hit another line or object, your measuring result will be incorrect!
2. Choose HEIGHT 1P method with the DME button. Press MODE.
3. Start the laser in VL402 by pressing the POWER button.
4. Aim at the power line and press POWER to measure the distance and the angle to the line. Proceed aiming until the angle ready measured, and you hear a signal. The height is now calculated and the EYE REF distance automatically added. Repeat point 4 if needed.
5. Accept the height with a press at MODE. To proceed to measure tree heights, see this manual for instructions.
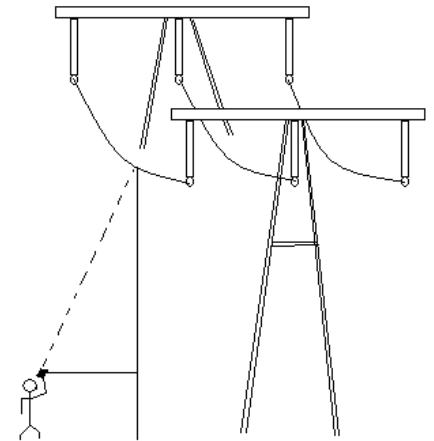

```
OBJECT HGT

METHOD ▶          X
                  ─
HEIGHT 1P         │
                  │
                  ─
```

```
SD        12.3

HD         5.0

H                 10.5

DEG       50.3
```

HEIGHT 2P

With HEIGHT 2P you can measure the height by using two measuring points. You will not need to be positioned at ground level under the power line. The laser or the ultrasound can be used to measure the distance to a point at the ground under the power line. Ultrasound can be used when it is difficult to find a good measuring point with the laser due to thick and dense vegetation.
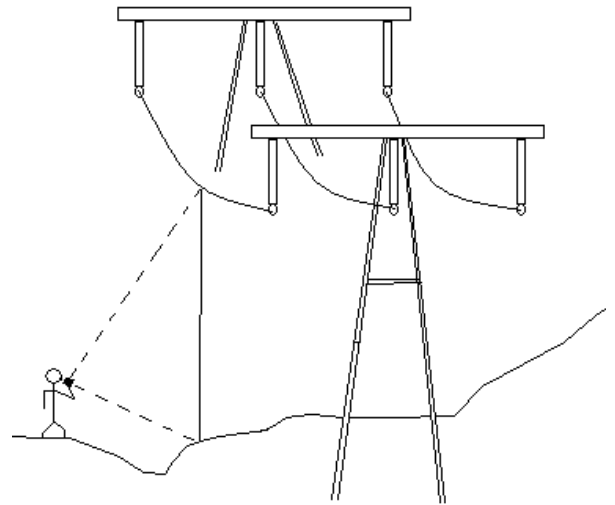
ULTRA SOUND (HEIGHT 2P)

1. Start the ultra sound T3 transponder.
2. Place the transponder under the power line. Make sure that the correct TRP.HGT (transponder height) in the SETUP menu is used for the occasion. The TRP.HGT can be set at any height, for example 0.0m or 1.3m if used with the plot staff and adapter.
3. Choose HEIGHT 2P with the DME button. Press MODE.
4. Aim at the transponder and press MODE button and keep it pressed until a signal is heard. Release the MODE button.
5. Aim at the power line and press MODE until you hear a signal.
6. The height is calculated and shown in the display.
7. Accept the measured height with one press at MODE and to proceed measuring tree heights, see this manual.

```
OBJECT HGT

METHOD ▶          X

HEIGHT 2P
```
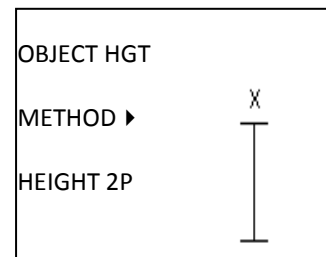
```
M.DIST

 DME (MODE)

LASER (POWER)
```

LASER (HEIGHT 2P)

1. Choose HEIGHT 2P with the DME button. Press MODE.
2. Start the laser with a press at POWER.
3. Aim at the power line and press POWER to measure the distance and angle to the line. Make sure that no objects are positioned above the line that you intend to

   measure. Proceed aiming at the power line until the angle is measured and a signal Is heard. Repeat point 3 if needed.
4. Measure the angle to a point under the power line. It is preferable to mark this point prior to the measuring, since it is difficult to estimate where it is. Aim and keep the MODE button depressed, and until you hear a signal.
5. Heights are calculated and shown in the display.
6. Accept the height with a press at MODE and to proceed to measure tree heights, see the manual.

OBJECT HGT
METHOD ▶
HEIGHT 2P

M.DIST
DME (MODE)
LASER (POWER)

TO MEASURE TREE HEIGHTS

After having registered the distance to the power line, proceed to measure tree heights. Tree heights are measured by standing in perpendicular position under the line facing the tree. The VL402 offer four different methods to calculate tree heights. Depending on where the tree is standing and in type of environment and terrain, you can choose appropriate method:

SD	12.3
HD	5.0
DEG	50.3
H1	10.5

HEIGHT 1P	Laser measuring and tree top angle.
HEIGHT 3P	Laser measuring at tree stem and angle at tree top and base
HEIGHT 2P	Laser measuring and angle at tree top and base.
HEIGHT2PL	Laser measuring and angle to tree top and base.

HEIGHT 1P

If the tree base is equal to ground level underneath the power line, one measuring operation is enough to calculate the height.

1. Stand under the power line.
2. Choose HEIGHT 1P with the DME button. Press MODE.
3. Start the VL402 laser with a press at the POWER button.
4. Aim at the tree top and press POWER to measure this distance. Continue aiming at the top until the angle has been measured and you can hear a signal.
5. The EYE REF distance is automatically added to the calculated height. Repeat point 4 if needed.
6. Press MODE to accept the result.
7. The VL402 will calculate the minimum theoretical distance between the top and the power line. If this result is negative (NOT OK) the tree may hit the power line if felled.
8. Press MODE to proceed to measure the next tree.

TREE HGT
METHOD ▶
HEIGHT 1P

NOT OK	OK
DIFF.	DIFF.
-1.0M	5.0M
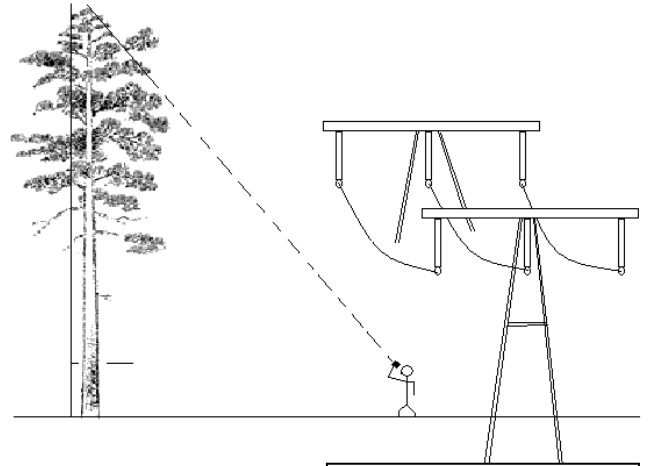
SD	22.3	
HD	15.0	
H		20.5
DEG	35.3	

HEIGHT 3P

Height 3P measuring is best used when the tree base is visible and not leveled with the ground under the power line.
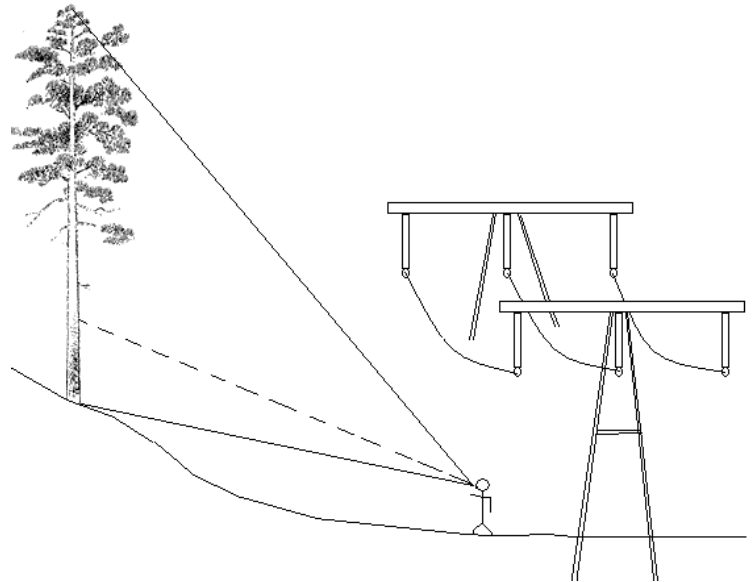
1. Stand under the power line.
2. Choose HEIGHT 3P with the DME button and press MODE.
3. Start the VL402 laser with a press at the POWER button.

4. Aim at any point on the stem and press POWER to measure the distance and angle. Continue aiming. When the angle is ready measured, you will hear a signal.
5. Aim at the tree base and measure the angle by <u>pressing the MODE button and keeping it depressed</u> until you hear a signal. Release MODE.
6. Aim at the tree top and measure the angle by <u>pressing the MODE button and keeping it depressed</u> until you hear a signal. Release MODE.
7. Press the MODE button to accept the measuring results.

TREE HGT
METHOD ▶
HEIGHT 3P

8. The VL402 calculates the minimum theoretical distance between the tree top and the power line. If the result is negative (NOT OK) the tree may hit the power line if felled.

SD	22.3
HD	15.0
H	20.5
DEG	35.3

9. Press MODE to proceed to measure the next tree.

NOT OK
DIFF.
-1.0M

OK
DIFF.
5.0M

HEIGHT 2P

When the vegetation is dense and the tree base is difficult to spot, it is recommended to use the HEIGHT2P measuring method. Preferably work with the ultrasound transponder, also if laser measuring is possible.
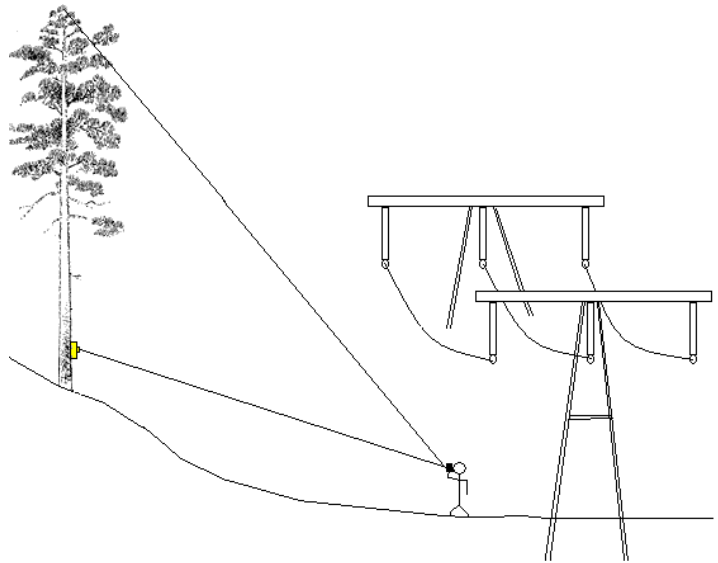
1. Start the T3 ultra sound transponder.
2. Pin the transponder to the tree stem. Make sure that the TRP.HGT in the

   SETUP menu is correctly set at the height where the T3 transponder actually is placed, for example at 1.3m (normal breast height).
3. Choose HEIGHT 2P with the DME button. Press MODE.
4. Stand under the power line and aim at the T3 transponder, <u>press MODE and keep MODE depressed</u> until you hear a signal. Release MODE.
5. Aim at the tree top and press MODE until you hear a signal.
6. The height is calculated and shown in the display.
7. Press MODE to accept the measuring result.
8. The VL402 calculates the minimum theoretical between the tree top and the power line. If the result is negative (NOT OK) the tree may it the power line if felled.
9. Press MODE to proceed to measure the next tree.

OBJECT HGT

METHOD ▶

HEIGHT 2P

X

M.DIST

DME (MODE)

LASER (POWER)

NOT OK

DIFF.

-1.0M

OK
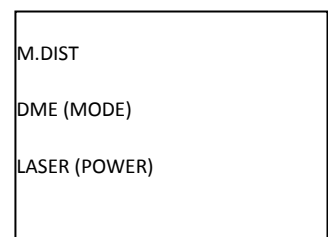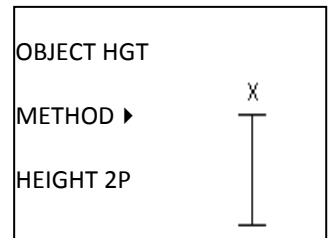
DIFF.

5.0M

HEIGHT 2PL

The HEIGHT 2PL method is recommended to use for leaning trees. The angle and distance to the tree top and tree base are measured.

1. Stand under the power line.
2. Choose HEIGHT 2PL with the DME button. Press MODE.
3. Start the VL402 laser with the POWER button.
4. Aim at the tree base and press POWER to measure the distance. Continue aiming until angle measuring is ready and you hear a signal.
5. Aim at the tree top and press POWER to measure the distance. Continue to aim until the angle measuring is ready and you hear a signal.
6. Press MODE to accept the measuring result.
7. The VL402 will calculate the minimum theoretical distance between the tree top and the power line. If the result is negative (NOT OK) the tree may hit the power line if felled.
8. Press MODE to proceed to the next tree.

```
OBJECT HGT

METHOD ▶            X
                    |
HEIGHT 2P           |
                    |
```
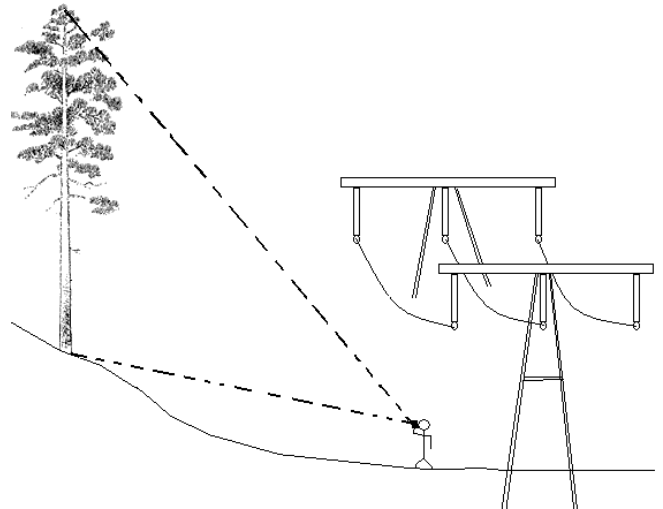
```
NOT OK

DIFF.

-1.0M
```

```
SD      22.3

HD        15.0

H   20.5

DEG      35.3
```

```
OK

DIFF.

5.0M
```

TRANSFER OF DATA USING IR

The IR transfer can be activated in any measuring mode. Just press the MODE button once.

Data format

'1 NNNN' Height 1   (the 2 (two) last measured heights are transferred)

'2 NNNN' Height 2

'3 NNNN' not used

'4 NNNN' H-Dist

5 ANNN' Angle A='+','-'   (gradients)

Baud=1200,7 bit Data, Even Parity

BATTERY INDICATOR (LASER AIM DISPLAY)

Battery has enough power for use.

Battery power is getting low.

Battery power is low, image of battery is flashing and battery should be replaced.

The battery power is also shown in the Vertex (-window) display. The battery is exhausted and should be replaced when the battery symbol in the Vertex display shows empty.
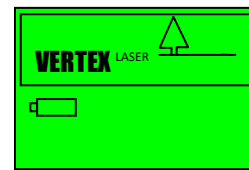
CHANGING THE BATTERY

1. Open the battery chamber cover using a coin or similar and rotate it following the "Open/Close" indication. Due to the water and dust-resistance seal, it may not open easily.

2. Install the new battery with the [+] and [-] correctly positioned.

3. Screw the cover back in place using a coin or similar. Confirm the cover to be correctly closed.

BATTERY LIFE

A new battery should last to take about 3000 measurements at 20ºC/70F. Temperature and target shapes are examples of variables that can change the lifetime for batteries. The automatic, energy-saving turn-off function ensures the longest possible life for the battery. The automatic turn-off time is set to approximately 8 seconds for the Laser unit and about 1 minute for the Vertex unit.

VL402 V1.1 BLUETOOTH®

This section contains information valid for Vertex Laser model VL402 or Laser L402 with built-in Bluetooth®.

VL402 BT V1.1   DME, DELTA, Bluetooth

VL402 V1.1   DME, DELTA

L402 BT V1.1   DELTA, Bluetooth

L402 V1.1   DELTA

VL402 can send wireless data to handheld computer or PC with Bluetooth. The connection is made when the VL402 instrument is set in slave-mode.

Certain computers require an activated pin code to connect. The code should be activated in menu BLUETOOTH. The VL402 uses the following pin code: **12345.** Use this code if the function for pin code is activated. To activate Bluetooth in the VL402 select menu BLUETOOTH. Activate pin code if necessary (see above) and set menu choice '—' to 'ON' using the arrow keys. An external device can now connect to the VL402.

Data of measuring result is sent with a short press on the Mode key after having measured (height, angle or distance).

The VL402 is set to disconnect the Bluetooth function 20 minutes after having turned off the instrument VL402. Note that the VL402 will consume more battery with the Bluetooth function activated. To save battery, it is recommended to manually turn off the Bluetooth function when not in use. Deactivate Bluetooth by changing 'ON' back to '—' in the BLUETOOTH menu.

If the Bluetooth function is active and the VL402 instrument has been turned off, a message appears in the instrument display telling that the Bluetooth is running.

Make sure that the distance between the external, connected unit and the VL402 does not exceed 10 m/32ft which is the maximum distance for data transfer.

NOTE 🅱 IS

TURNED OFF

AFTER

20 MINUTES
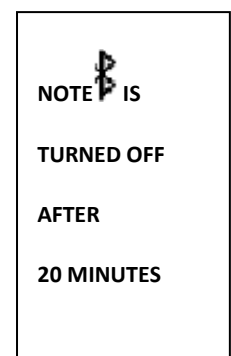
BLUETOOTH IN COMMON COMPUTER UNITS

Documentation can often be limited on which ports in a computer unit that is dedicated for the Bluetooth function. The operator may have to try his way through. Below are examples of ports in some common handheld units:

ALLEGRO

The COM6 is usually the internal Bluetooth port

RECON

The COM4 is usually the internal Bluetooth port

DATA FORMAT

Data from the VL402 is sent serial as text according to the below:

Data packet containing a total of 40 signs.

1 0000 [LF][EOL]

2 0000 [LF][EOL]

3 0000 [LF][EOL]

4 0000 [LF][EOL]

5 +000 [LF][EOL]   (At negative angle '+' inserted with '-')

LF=Linefeed (ASCII 13)

EOL=End of line (ASCII 10)

HEIGHT MEASURING

Line 1:   1:a height (dm alt. feet X 10)

Line 2:   2:a height (dm alt. feet X 10)

Line 3:   3:a height (dm alt. feet X 10)

Line 4:   Horizontal distance to object (dm x 10 alt. ft X10)

Line 5:   Angle to object (grades X10)

DISTANCE MEASURING

Line 1:   Distance to transponder (cm alt feet X 10)

Line 2:   0000

Line 3:   0000

Line 4:   0000

Line 5:   Angle to object (grades X10)

*If the angle (line 5) has a value larger or less than zero (0), the distance will be the calculated horizontal distance.

SIGN FORMAT BLUETOOTH

The transfer speed and number of stop bits are set automatically by the receiver. Number of bits per sign are 8 data bits and no parity.

TECHNICAL SPECIFICATION

VERTEX LASER VL402 INSTRUMENT

Size	95 x 72 x 58 mm / 3.7" x 2.8" x 2.3"
Weight	260 g / 9 oz (battery included)
Battery	1 x CR 2 Lithium 3V
Power consumption	60mW
Temperature range	-15° to +45°C / 5F to 113F
Height	0-999 m/ft
Resolution height (display)	0.1m/ft
Meter / Feet	Yes
Buzzer	Yes

Angle

Angle range	-55 to +85deg
Deg / Grad / %	Yes
Resolution angle	0.1deg
Accuracy	0.1deg
Vertex aim	Aim point; 1x magnification
Data Transfer	IR and Bluetooth® class 2, pin code 12345

LASER

Laser Class FDA Class 1/EN60825-1 Class 3A	
Distance non-reflective target Max. 350m/400yard (aut.setup reflect/nonreflect target)	
Distance reflective target	From 130m to 900m / 150yard to 999yard
Resolution (display)	0.5m/yard at distance <100m/yard, else 1m/yard
Accuracy	$\pm$0.4m/yard at distance <100m/yard, else $\pm$1m/yard
Rain mode	Yes, automatic
Number of measurements	approx. 3000
Laser aim	Reticule; 8 x magnification
ZipThru >140m/yards (filter)	Yes
Scan (continuous measuring)	Yes
Meter / Yards	Yes

ULTRASOUND

Distance (max) to transponder T3	>30m / 100ft
Distance (max) to T3 with 360° adapter	>20m / 60ft
Resolution	0.01m / 0.1ft
Accuracy	1% or better

TRANSPONDER T3

Size:	Diameter 70mm / 2.8"
Weight:	85g / 5oz (battery included)
Battery:	1x 1,5V AA Alkaline
Power consumption:	9mW

SAFETY AND OPERATION PRECAUTIONS

To avoid injury or material loss, please read this safety and operation precautions thoroughly:

- Never look directly at the laser beam or directly at the sun when using the Vertex Laser instrument.
- Do no use the Vertex Laser instrument together with other optical instruments, such as binoculars and lenses. Using an optical instrument together with the Vertex Laser increases the danger of eye damage.
- Do not depress the POWER button while aiming with the eye or looking into the optics from the objective side.
- Do not disassemble the Vertex Laser instrument. Any signs of disassembling automatically withdraw any warranties and the manufacturer does not guarantee the product.
- If the Vertex Laser instrument body cover is damaged, or if the instrument emits a strange sound due to dropping, remove the battery and stop using immediately.
- Never place the Vertex Laser in an unstable place.
- Never look through the Vertex Laser instrument while walking.
- If you should develop any symptoms of eye irritation or skin inflammation around the eye due to use of the rubber eyecup, consult a doctor immediately.
- If the Vertex Laser instrument should fail to operate correctly, discontinue use and consult the manual. If you are unable to fix the problem, contact your local dealer for instructions or where to send the instrument for repair.
- The VL402 instrument has built-in Bluetooth® for data transfer to external devices. There may be local restrictions on the use of both Bluetooth® and laser technology. It is the operator's responsibility to control that the technology in the instrument is permitted to use in the area where the instrument is operated.

CARE, STORAGE AND MAINTENANCE
- Store the Vertex Laser in its soft case when carrying. Do not swing the instrument by its strap.
- Although the Vertex Laser instrument is water and dust resistant, it should not be used in water and it is not waterproof.
- Use a soft, clean and dry cloth to clean the Vertex Laser instrument if exposed to rain, water, sand and mud. Do not use alcohol, benzene, thinner or other organic agents to clean the instrument's main body! Always clean as soon as possible after the exposure, and always store the instrument in a dry, cool place and away from direct sunlight.
- Use a soft oil-free brush to remove dust from the lens surface. To remove stains or smudges (fingerprints etc), wipe lenses gently with a soft clean cotton cloth or oil-free lens tissue. Stubborn smudges can be removed with a small amount of pure alcohol using extra care to avoid scratching of the lens surface. The tissue should only be used one time.
- Do not expose the instrument to excessive heat or ultraviolet rays, since this may negatively affect or damage the unit.
- Avoid pushing the POWER button when not using the Vertex Laser instrument.
- When exposed to sudden changes in temperature or high humidity, water condensation may appear on lens surfaces. Do not use the Vertex Laser instrument until this condensation has evaporated. Dry the instrument at room temperature and store in a cool, dry place.
- Keep the instrument and any parts of and for the instrument out of reach of small children. Consult a doctor immediately if a small child has swallowed any parts of the instrument or its packing.

NOTES ON BATTERIES
- Batteries should always be removed when exhausted or during longer periods of non-use.
- Make sure that batteries are installed correctly in their + and – position.
- Rinse skin or eyes well with water if exposed to battery fluid. If swallowed, contact a doctor
- Do not short-circuit battery chamber terminals, and do not carry batteries with keys or coins in a pocket. This may short-circuit the batteries.
- Keep away from fire and water and do not disassemble batteries.
- Do not attempt to charge batteries. Avoid strong vibrations, shock or extremes in temperatures for stored batteries.
- If handled incorrectly, batteries may rupture and leak, corroding equipment and staining clothing

TROUBLESHOOTING LASER

Symptom	Check points
Laser does not turn on/ Display fails to illuminate	**Depress POWER button** **Check and replace battery if necessary**
Target range cannot be obtained	Make sure that nothing is blocking the laser emission aperture and laser detector. **Make sure that the laser emission aperture and detector is clean. Clean if necessary (*see page 17, Care, storage and maintenance*).** **Target shape and condition may be inappropriate to reflect the laser beam. Slender targets, targets with small reflecting surface, targets with diffusing reflective surface, targets that do not reflect the laser beam, targets with pronounced depths, targets measured through glass and weather conditions such as snow, rain or fog can affect the measuring. Replace battery if necessary.**
[---] appears	Hold unit steady while pressing the POWER button. Make sure the target is within the measuring range (10m/10.5yds – 400m/437yds)
Close targets cannot be measured	**Make sure that nothing is blocking the target**
Targets beyond a certain distance **cannot be measured**	**Make sure that nothing is blocking the target**
Measurement results are unstable	Replace battery Make sure that target shape and condition can reflect the laser beam. Hold the unit steady while pressing the POWER button **Make sure that nothing is blocking the target**
Incorrect results are displayed	Replace battery Make sure that target shape and condition can reflect the laser beam. **Make sure that nothing is blocking the target**

TROUBLESHOOTING VERTEX

Symptom	Check points
No distance shown in the display	Check Transponder to be ON Battery in Transponder too low Disturbing and repeated noise in the surrounding background Using the wrong type of Transponder
Obtained distance values are unstable	Disturbing and repeated noise in the surrounding background Using the wrong type of Transponder
Obtained distance values are incorrect	Disturbing and repeated noise in the surrounding background The Vertex is poorly calibrated
Cross Hair sight will not go off	Check Transponder to be ON Battery in Transponder too low Disturbing and repeated noise in the surrounding background Using the wrong type of Transponder Angle to the object to measure too big – increase your distance to the object to measure
Vertex unit will not start	Battery power too low Battery inserted incorrectly
Transponder unit will not start	Battery power too low
No measuring values are presented	Check Transponder to be ON Battery in Transponder too low Disturbing and repeated noise in the surrounding background Using the wrong type of Transponder Angle to the object to measure too big – increase your distance to the object to measure Measuring instrument not held steadily enough Instrument has no Horizontal reference: obtain this by carefully tilting the instrument
Measuring results seem unrealistic or untrue	Disturbing and repeated noise in the surrounding background Measuring unit is not held steadily enough

SAFETY INFORMATION

Vertex Laser VL402 USA: 21CFR 1040.10, 1040.11 FCC Part 15 Class B; EU EN60825-1:1994 + all EU EMC directive
Type of equipment Distance and angle meter
Brand name or trade mark Vertex Laser
Manufacturer's name, address, telephone & fax no
Haglöf Sweden AB, Klockargatan 8, SE-882 21 Långsele, Sweden
Tel: +46 620-25585**, Fax:** +46 620-20581, info@haglofsweden.com; www.haglofsweden.com
The Vertex was CE marked 1999

WARRANTY AND SERVICE INFORMATION

Haglöf Sweden AB warrants that this product shall be free from defects in materials and workmanship, under normal intended use, for a period of 12 months after date of shipment. The warranty excludes the batteries, the accessories and any written materials. The warranty does not apply if the product has been improperly installed, improperly calibrated or operated in a manner not in accordance with the user's guide. Warranty is also automatically expired if the product has been opposed to external force and warranty is not applicable for cosmetic defects. The one-year limited warranty time covers obvious fabrication defects. Defects in the electronic components that are impossible for the manufacturer to detect prior to assembling and shipping of the product may occur. Haglöf Sweden AB can in no case be responsible for problems of this nature and has no liability for any loss of business, profits, savings, consequential damages or other damages resulting from use of the products described. Signs of misuse, cosmetic damage, accidents or equal automatically withdraw the warranty. The warranty is valid in the country where your Haglöf product has been purchased. A product covered by warranty will be object to exchange, service, and repair or according to special agreement between seller and buyer, within the frames of the limited warranty. Haglöf Sweden reserves the right to determine which option will be most suitable for each separate case after having examined and evaluated the product.

IMPORTANT ISSUES:

• For a valid warranty, a copy of invoice or dated receipt of your purchase must be presented. The serial number of the returned product has to be clearly stated upon return. Go to http://www.haglofsweden.com/PDF/HaglofRMA.pdf for return form/turn to your supplier for assistance.

• The return freight to us is on buyer's expense. After warranty repair or exchange, the return freight to you is on our expense. If warranty has expired or is null and void, all freights are on buyer's expense.

• If no original invoice can be presented upon shipment, or if two years or more have passed from date of purchase, a customs fee will be added by the applicable customs authorities and possibly in receiving country as well. These fees are on buyers account.

• We perform repair and service of products where warranty has expired when possible. Cost estimation will be sent to you after evaluating the returned product for cost approval. Please also see above paragraph on customs fees.

• Please do not hesitate to contact us or any Haglöf Sweden AB representative for questions or comments!

Any signs of misuse or negligence automatically withdraw our warranty commitments

SOFTWARE

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